

DISLOCATION OF THE HUMERUS COMPLICATED
BY FRACTURE AT OR NEAR THE SURGICAL
NECK, WITH A NEW METHOD OF
REDUCTION.¹

By CHARLES McBURNEY, M.D.,

OF NEW YORK,

SURGEON TO THE ROOSEVELT HOSPITAL.

WITH COLLABORATION OF

CHARLES N. DOWD, M.D.,

ASSISTANT SURGEON, NEW YORK CANCER HOSPITAL.

THE injury which is the subject of this paper has received careful study from numerous observers since a very early period, and the attention bestowed upon it has been much greater than I was at all aware of until, with the invaluable aid of Dr. Charles N. Dowd, I was able to study its history. It is interesting to note that so long ago as fifty years before Christ Pasicrates² described the injury, recommending reduction of the dislocation first, and treatment of the fracture afterwards, and Aristion, Heliodorus, Paul of Egina, Guy of Chauliac, and others, all recognized the importance of the injury and the difficulties encountered in its management. In 1839, Sir Astley Cooper,³ who was fortunate enough to meet with three cases, when reporting them, says, "Every intelligent, well-informed surgeon will now confess that no knowledge or exertion of skill could have prevented the deformity and loss of the natural motion which results from this formidable accident."

This statement is certainly not supported by subsequent

¹ Read before the New York Surgical Society, January 10, 1894.

² Malgaigne, *Journal of Surgery*, 1853, p. 81.

³ Guy's Hosp. Reports, IV, p. 277.

history, for, owing to fortunate ease of reduction, a number of cases have been successfully treated.

In 1843, Riberi¹ reported a case which he had treated by passive motion so as to establish a false joint at the point of fracture, the dislocated head of the humerus being left unreduced. The method of treatment made use of in this case is still known by the name of Riberi.

In 1852, Richet² read before the Surgical Society of Paris the history of a case of fracture of the neck of the humerus with dislocation of the head, and a very full discussion of the subject followed; and in 1884 appeared the thesis of Oger,³ in which were collected and compared the records of eighty cases, and many facts in regard to the frequency of the injury, its pathology, and the results which follow it were presented.

A most satisfactory discussion of the subject is to be found in the book on dislocations, by L. A. Stimson;⁴ and in the *Revue de Chirurgie*, 1892, is a very complete paper by Poirier et Mauclaire,⁵ in which fracture of the humerus with dislocation of the head is studied at length, and additional cases are given.

The accident is a rare one, for a careful extended search has revealed the records of only 117 cases, and no single observer has met with more than five. Of course, there are many unreported instances.⁶

The cause of the injury has usually been stated as a fall upon the shoulder or a heavy blow received directly upon the same part, while in other reports the patient is said to have fallen upon the outstretched hand or upon the elbow. The exact method by which the injury is produced is hardly capable of demonstration, nor is the statement of the patient of much value, for, as in other injuries, the patient almost invariably believes

¹ Oger, *Paris Thesis*, 1884.

² *Mémoires de la Société de Chirurgie*, 1853, t. III, pp. 445-468.

³ Oger, *Paris Thesis*, 1884.

⁴ Stimson, *Treatise on Dislocations*.

⁵ *Revue de Chirurgie*, October 10, 1892.

⁶ In 117 cases, 46 dislocations were stated to be subcoracoid; no location given in 36, and 11 were called axillary. Most of these last two classes were probably subcoracoid; 16 were called subclavicular, 7 subglenoid, and 1 subspinous.

that when he has fallen and injured himself, he has struck upon the part which he finds most seriously damaged.

It seems probable that in the larger number of instances the dislocation is produced by the usual mechanism,—that is, through violent sudden abduction of the arm, as in a fall upon the hand or elbow, and the head of the bone having become fixed in its new situation, that fracture takes place through continued abduction, combined perhaps with forced rotation, the edge of the glenoid cavity or of the acromion acting as a fulcrum. The complication has also been produced a good many times by the surgeon in his efforts to reduce a simple dislocation. The dislocation has been usually subcoracoid, occasionally subglenoid, and very rarely subspinous.

The line of fracture has been varied. In some cases it had passed accurately through the anatomical neck, but in much the larger number the fracture has been of the surgical neck, either transverse or obliquely upward through the tuberosities or obliquely downward through the shaft.¹ In most cases the lower fragment, that continuous with the shaft, has been found lying on the outer side of the upper fragment, and more or less drawn upward and towards the glenoid cavity.

The diagnosis is not always easy, swelling of the soft parts about the shoulder increasing the difficulty. If the absence of the head of the bone from the glenoid cavity, and its presence at another point can be determined, the diagnosis of dislocation is of course clear. Usually the mobility of the shaft of the humerus, and the readiness with which it falls close to the side of the thorax, would prove the presence of fracture, the existence of dislocation of the head having been determined, but, as has been pointed out by Stimson,² the same mobility may exist in a case of dislocation without fracture, provided the capsule of the joint has been sufficiently lacerated. The most important diagnostic

¹ The fracture in 117 cases was in 69 at the surgical neck; in 27 at the anatomical neck; at the "neck" in 11; both anatomical and surgical necks were fractured in 6 cases; 1 case was comminuted, and the "upper part" of the humerus was fractured in 3.

² Treatise on Dislocations. Stimson, p. 255.

features, which were clear in the case I report, are the presence of the head of the bone in an unnatural position, and its failure to move when free rotation of the arm is made.

Shortening of the limb and crepitus may or may not be capable of definition. A careful examination, with the aid of anaesthesia, will hardly fail to result in a definite diagnosis, provided that the injury is not too old, and that union between the fragments has not occurred.

The treatment of this injury has always excited interest and has given rise from time to time to much discussion, for the condition of a patient who has suffered both fracture and dislocation is much worse than that of one who has received only one of the two lesions. When both injuries exist at once, the difficulties of making reduction of the dislocation, and of properly treating the fracture, and the liability to vicious union are much increased, and there is no prospect that after union has occurred, free and painless use of the arm can ever be made with the head of the bone out of place.

For many years, and particularly since the introduction of anaesthesia has rendered the feasibility of the reduction of all dislocations greater, surgeons have been agreed that, whenever fracture and dislocation of the same bone has occurred, the dislocation should first be reduced if possible. This is clearly the proper practice, for not only do the difficulties of the reduction of a dislocation constantly increase with its age, but also the treatment of the fracture, while the dislocation is unreduced is certain to be imperfect on account of the malposition of the upper fragment, and the displacement and tension of muscle and other tissues. Therefore, in a very large proportion of the cases on record attempts at reduction of the dislocation were made, sometimes with success, oftener with failure. Sir Astley Cooper believed that if reduction was to be effected at all it would probably be with the aid of extension and with the heel or knee in the axilla. But it is evident that, when the humerus is fractured near the head, to make use of extension with the heel in the axilla is both a useless and dangerous procedure. This method depends for its value upon the integrity of the bone,

so that the extending force may be conveyed to the head, and the shaft of the bone be also used as a lever.

As suggested by Stimson,¹ *gentle* traction in the proper direction may be useful, "for the periosteal connection may be sufficient to make it practicable thereby to bring the upper fragment into a more favorable position." With this exception, methods of reduction depending upon traction on the shaft and rotation of the same part are out of place and dangerous. The active method of reduction, recommended by almost all writers of modern times, and which has been not unfrequently successful, and always harmless, is that of direct manipulation of the head of the bone into place by pressure with the thumb and fingers. When anaesthesia is made use of, the situation of the head of the bone being favorable, and the laceration of the capsule of the joint sufficiently great, this method of direct impulsion of the head may succeed, and should always be tried. In eighty cases, of which the records in regard to method of treatment are sufficiently accurate for reference, attempts at reduction were made within a reasonably short period. Direct pressure upon the dislocated head of the humerus was the method usually employed. In thirty-six cases reduction was accomplished, and in forty-four cases all efforts failed.

In six of these cases more or less violent and repeated efforts, by means of traction, rotation, etc., resulted in death.²

The difficulty in making reduction is, of course, due to the small size of the upper fragment, the existence of the fracture destroying one's power to control the movements of the head of the bone by means of the shaft. It is to a means of overcoming this difficulty that I shall ask your attention in connection with the case which I report.

Failing to make immediate reduction of the dislocation, some surgeons have depended upon the old method, which consists in treating the fracture until firm union has occurred, and then, using the repaired shaft for extension, rotation, or leverage, en-

¹ Treatise on Dislocations. Stimson, p. 256.

² Oger, Paris Thesis, 1884. Poirier et Mauclaire, *Revue de Chirurgie*, October 10, 1892.

deavoring to reduce the dislocation. This method has but little to recommend it. In the first place, union may fail to occur at all, in which case the difficulty in making reduction will be very much increased by the lapse of time, in fact, reduction will very probably have become impossible. Secondly, owing to the mal-position of the upper fragment, union will be very likely to be imperfect or vicious, and even if firm union occurs, it is likely to give way under the vigorous manipulations necessary to reduce a dislocation, already six to eight weeks old, before the attempt is made. This method has been made use of in ten cases. These have all been reported by Oger,¹ and a careful search through subsequent literature has failed to reveal other records. In seven of these cases, persistent, often violent and repeated, efforts failed to accomplish reduction. Three of the ten are reported as having been successful, but a reference to the original reports shows that one of the three (Warren's) escaped from observation after three days; a second (Langenbeck's) is noted as a successful reduction by apparatus, eleven weeks after the original injury, and the third (Baroni's) is reported as having been successfully treated about sixteen days after the injury, "without breaking the fragments apart."

Complete failure to effect primary reduction, and the very proper rejection of the second plan, which has just been referred to, leaves one still the choice between two different methods.

To avoid the usual greater disability and pain accompanying an unreduced dislocation, one might select the method of treatment known as that of Riberi, which consists in attempting, by passive movements, made from the beginning, to establish a false joint. In suitable cases, where the fracture has taken place at a high point, and the lower fragment has been raised by muscular contraction outside of the upper one, and near to the glenoid cavity, this method may meet with success,—that is, continued passive motion may establish a *nearthrosis* between the lower fragment and the glenoid cavity, so that a moderate amount of movement of the upper arm may result. Reports as to the exact condition obtained by this method are singularly wanting.

¹ Oger, *Paris Thesis*, 1884.

Seven cases are reported as having been treated by Riberi's plan, either without attempt at reduction or after such attempt had failed. At the end of periods varying from six months to four years, these patients were reported as "having use of the arm," being "able to carry the hand to the head," etc. No account is given as to the pain or disability caused by the dislocated head of the bone.

The suggestion of this method by Riberi was due, doubtless, partly to the recognition of the difficulty of making reduction, and partly to the fear, well grounded at that time, of anything in the nature of operative interference. But when one considers that the presence of the head of the bone in an unnatural situation has usually been the source of great discomfort, and even of severe pain and serious disability, one might well hesitate to adopt a plan uncertain to succeed at all in accomplishing its object of establishing a false joint, painful and protracted in its application and imperfect in its final result. At the present time, I think the surgeon should apply the method only to such cases as present positive contraindications (such as age, debility, or complicating injuries), to more radical treatment, or to such patients as positively refuse operative interference.

But there still remain to be considered those cases where reduction of the dislocation has failed, and where no contraindication exists to the making of further effort to better their condition.

Shall an attempt at reduction by open arthrotomy be immediately made, with subsequent treatment of the fracture? or shall one select the simpler operation of resection of the head of the bone, and so render almost certain the formation of a painless, and often useful, false joint?

These questions cannot be answered dogmatically, nor are there such statistics bearing upon the point as to warrant the laying down of definite rules of treatment. The reduction of the dislocation, even if open arthrotomy is required, is certainly the most attractive method, for it offers the prospect of a more nearly perfect final result than the other plan.

In a recent injury the obstacle to reduction would be,

almost certainly, the limited opening in the capsule of the joint. The glenoid cavity would be fresh and free from the new-formed tissue, which renders the reduction of old dislocations by open arthrotomy so difficult, and sometimes impossible, and the operation of enlarging the rent in the capsule would not be especially difficult or dangerous. If the dislocation were reduced, suture of the fractured bone-ends would naturally be made at once. If union failed to occur, the head of the bone would be in the most favorable position possible. If reduction even by arthrotomy failed, the head of the bone should certainly be resected at once, as its continued presence out of place would be a very probable source of danger and discomfort, and would complicate the treatment of the wound.

Reasons existing for not performing the operation of open arthrotomy and reduction of the head, resection of the latter might well be left for subsequent consideration, and then after all acute symptoms had subsided be resorted to in case sufficient pain or disability existed to call for this secondary operation.

At least six cases of open operation can be referred to (Nos. 112, 113, 114, 115, 116, 117), in every one of which the head was, either primarily or secondarily, removed.

AUTHOR'S CASE.

On the evening of June 17, 1893, a gentleman, aged forty-five, tall and of heavy build, jumped from his carriage, the horses of which had become unmanageable, and fell, striking probably upon his right hand. He arose with difficulty, and found that his right arm was disabled. His family physician, Dr. F. H. Rankin, of Newport, R. I., visited him within an hour, and, with the aid of ether, made a careful examination. Dr. Rankin recognized a dislocation of the head of the humerus, complicated by a fracture at or near the surgical neck of the same bone. He made vigorous and prolonged efforts to reduce the dislocation without success. On the following day two experienced surgeons were summoned in consultation; the diagnosis of the nature of the injury which had been made by Dr. Rankin was confirmed by them, and about thirty-six hours after the accident had occurred ether was again administered and prolonged efforts by manipulation, extension, and otherwise, were made to reduce the dis-

location. All attempts to accomplish reduction failed, and, after consultation, it was agreed that further effort was useless and perhaps dangerous, and that the wisest course was to treat the fracture with a view of obtaining union, and after union had occurred to again attempt reduction of the dislocation. The arm and shoulder were therefore encased in a well-padded wire-netting gutter-splint, and the whole bandaged securely to the thorax. During the following week the patient was comfortable, suffering but little pain, and moved about his room with ease. On June 26, nine days after the injury, I visited the patient for the first time in consultation with Dr. F. H. Rankin and Dr. C. B. Porter. Ether was again administered to allow of a thorough examination of the injury. But little swelling existed. Complete flattening of the shoulder and marked prominence of the acromion were noted. The arm was placed without resistance against the side of the thorax. The head of the humerus could be distinctly felt beneath the coracoid process, where it seemed to be very firmly fixed. Rotation of the shaft of the humerus was easily made; but this movement imparted no motion to the head of the bone. It was clear that fracture existed, and further examination also showed that the line of fracture was very oblique, running from a point very near the head downward and outward to a point about three and one-half inches from the acromion. As fracture existed, it would have been, of course, futile and even dangerous to use the shaft of the humerus and the forearm in attempting to reduce the head by manipulation, and extension applied through the parts below the fracture could not be expected to affect the head of the bone above the fracture. The portion of shaft which remained attached to the head was far too small to be seized with the fingers and made use of as a lever in attempting reduction by any method, and vigorous attempts to dislodge the head of the humerus by acting directly upon it met with absolute failure. I was entirely satisfied, as were also Drs. Porter and Rankin, that the dislocation could not be reduced by any method as yet proposed unaided by operation. The plan of treating the fracture and then after union had occurred attempting reduction did not seem satisfactory. In the first place, there was no *certainty* that union would occur. Then at the end of five or six weeks, if union were strong enough to justify an attempt at reduction, the difficulties would be very much increased, and liability to refracture should be considered. Lastly, the history of the method, with only three successes against seven failures, was not encouraging. The

method of abandoning reduction and attempting to form a false joint between the upper end of the shaft and the glenoid cavity promised at first a very imperfect result. To both of these methods arthrotomy with immediate reduction was to be preferred, but this was a grave operation, which, while it has resulted well in a few cases and has the endorsement of high surgical authorities, can possibly never give a *perfect* functional result. I therefore proposed the following plan, which I had had in mind for about a year in the event of meeting with a suitable case: An incision should be made through the soft parts on the outer aspect of the upper fragment down to the bone, a hole drilled in the bone, a stout hook inserted, and direct traction

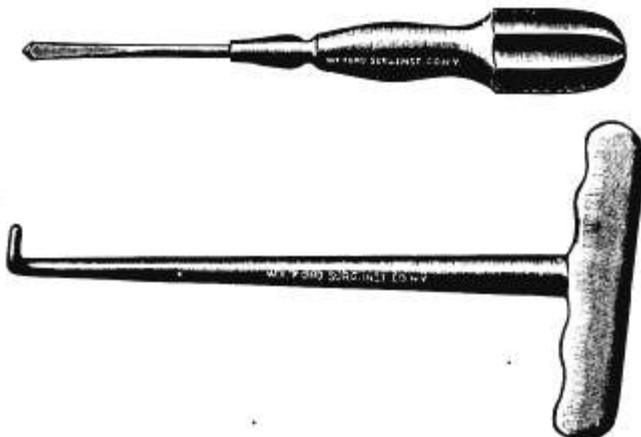


FIG. 1.—Traction-hook and drill.

made upon the upper fragment in the proper direction. The proposition was assented to, and the patient came to New York a few days later to have the attempt made. The operation was done on July 1, 1893, two weeks after the original injury, in the presence of Dr. W. M. Polk, and with the assistance of Drs. F. W. Murray and H. W. Taylor. In the few days intervening after my first examination of the patient I had made a suitable drill (Fig. 1), and also a blunt right-angled hook, the blunt end of which corresponded exactly to the size of the drill. An incision about one and one-half inches long was now made, being about one inch below the acromion. This

incision was carried through the deltoid muscle to the outer surface of the upper fragment. With the drill a hole was then made which passed completely through the very obliquely-bevelled bone. The hook was inserted as far as it would go. Dr. Murray then slowly carried the forearm and upper arm outward and nearly to a right angle with the body, and, with the powerful hook in the right hand and the fingers of the left hand on the head of the humerus, I made vigorous traction in the same direction. The effort required was very considerable, but no change in direction was needed, and reduction was accomplished at the first attempt. Examination through the wound then revealed some interesting features. The absence of crepitus had been noted before, and was now explained. While the dislocation existed the upper fragment projected laterally at a far greater angle than could be well appreciated through the thick deltoid. Consequently the fragments were never in apposition, and to have

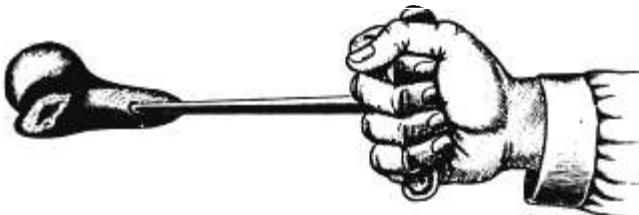


FIG. 2.—Traction-hook inserted into dislocated fragment.

brought the fracture-surfaces together it would have been necessary to carry the elbow away from the body to a distance of from eight to ten inches. Before doing the operation I had expected to suture the fragments together with heavy catgut, but after the reduction of the dislocation was accomplished I found the apposition of the fragments to be so very perfect that I made use of only two deep catgut sutures, passed through the soft parts immediately overlying the bone. The arm could now be brought close against the side of the thorax without displacing the fragments. The wound was closed throughout with catgut, without drainage, a sterile dressing was applied, and the whole shoulder, upper arm, and forearm enveloped in a plaster-of-Paris case. Not the slightest interruption to health followed the operation, and after a week in bed the patient was able to walk about, using a sling to support the heavy splint. On the tenth day the splint

was removed and the wound examined. Primary union had occurred throughout, and a fresh plaster splint was applied. On the twenty-fourth day the second splint was removed. Quite firm union of the fragments was noted, and moderate passive movements of the shoulder-joint were made. A much lighter splint was then applied, the forearm being left exposed, only supported by sling. From the fifth week on passive movements of the shoulder and massage of this joint were made every day or two until the end of the seventh week, when the patient was able to return to his home in the country without apparatus of any kind, union of the fracture being completely firm, and voluntary movements of the shoulder-joint being satisfactory. Massage and passive motions were kept up, and the arm was very freely used. The patient was examined by me on October 26, and the functional results found to be perfect. The voluntary and passive movements of the right arm were as good as those of the left, and no atrophy of muscle existed, and no deformity at the point of fracture. At about the same time the patient was examined by Dr. W. M. Polk and by Dr. L. A. Stimson, the former declaring the result to be absolutely perfect, the latter detecting a slight restraint when the right arm was carried upward and outward to the extreme point. The patient claims that his use of arm is as good as before the injury.

While the skilful, though unsuccessful, efforts that had been made by experienced surgeons to effect reduction in this case, and my own observations as well, justify me in believing that reduction could not have been accomplished by any of the non-operative methods heretofore proposed, yet I should hesitate to present the plan which succeeded so well in this instance as of universal application. What it offers, however, is a means of harmlessly applying force in the right direction to the dislocated head whenever fracture takes place at or near the surgical neck, or so high in the shaft as to render manipulation of the upper fragment very difficult. What all observers have noted has been the difficulty of applying any more force than could be exerted with fingers and thumbs to the small upper fragment. Of course, the upper fragment could be seized after exposure through an incision with powerful forceps, but the crushing of bone that would necessarily accompany any attempt to make strong traction would prove a

serious objection. I would also suggest the plan which I have described as applicable to those cases where, in an attempt to reduce a simple dislocation, the humerus has been broken at or near the surgical neck. When this accident has happened, the usual practice has been to regard reduction as hopeless, and to simply treat the case as one of fracture. The result in such cases has been great disability and often very serious pain. To escape these conditions, numerous modern surgeons have proposed excision of the dislocated head and the establishment of a false joint. With the instrument which was used in the case just reported a large amount of force can be applied to the dislocated head of the bone in any desired direction, and although extreme force is not usually required in the reduction of dislocations, yet the effort demanded is often very considerable. With the aid of Dr. George Huntington, professor of Anatomy at the College of Physicians and Surgeons, I have made some experiments to test the resistance of the fresh humerus to force applied in the manner described. A fresh humerus was sawed through about three inches below the tuberosities. This was suspended by wire wound about its neck from the ceiling. The hook was inserted in a hole drilled in the outer surface of the bone and various weights were applied. A weight of 175 pounds was borne without in the slightest degree enlarging the opening or fracturing its edge. A very considerable amount of force can be applied with the same instrument in making rotation of the fragment, but the exact amount that can be used without splitting the bone I am not able to state. It has occurred to me that the instrument might be useful in some cases of old dislocation of the humerus in applying counter-extension to the scapula. We all know how movable that bone is, and how difficult it is to properly make counter-extension by means of any contrivance when much traction is made upon the arm. The base of the spine of the scapula—that is, the curved margin which connects the acromion process and the neck of the scapula—is formed by a quite thick and strong mass of bone admirably arranged by shape and direction of fibre to resist force applied nearly in the direction of the upper border of the spine. Throughout a distance of from

two to three centimetres the mass of bone forming the base of the spine of the scapula is quite thick enough to permit the use of the same drill and instrument that were used on the humerus. Measuring from the tip of the acromion process backward along its dorsum, the drill can be safely entered at a point situated from five to five and a quarter centimetres posterior to the tip.

I applied the same test to the scapula that had been applied

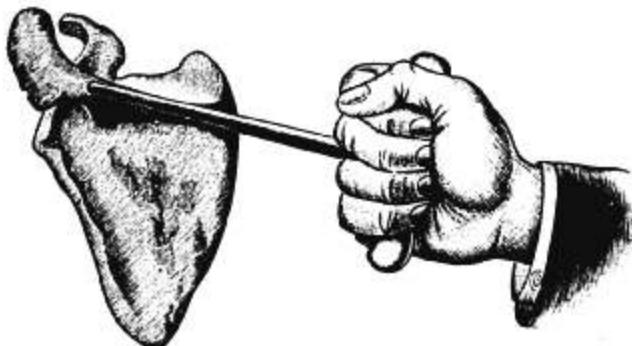


FIG. 3.—Traction-hook applied at base of acromion process of scapula.

to the humerus. The fresh scapula was suspended by its neck, the hook inserted at the point mentioned, and various weights attached. A weight of 175 pounds was borne without the slightest injury to the bone. This is a considerably greater force than can be applied in the form of traction by the average individual, unless with the aid of pulleys, and when pulleys are used all reasonable control of the force is lost.

LIST OF CASES AND REFERENCES.

- (1) *Aujer*: Oger, Thèsis, Paris, 1884, Obs. 1.
- (2) *Cooper*: Guy's Hospital Report, v, IV, p. 273.
- (3) *Cooper*: Guy's Hospital Report, v, IV, p. 273.
- (4) *Cooper*: Guy's Hospital Report, v, IV, p. 273.
- (5) *Huguier*: Oger, l.c., Obs. IV.
- (6) *Malgaigne*: Traité des Fractures et des Luxations, t. II, p. 555.
- (7) *Bennett*: Brit. Med. Journ., 1881, I, p. 637.
- (8) *Bennett*: Brit. Med. Journ., 1881, I, p. 637.
- (9) *Bennett*: Brit. Med. Journ., 1881, I, p. 637.

- (10) *Bennett*: Brit. Med. Journ., 1881, I, p. 638.
- (11) Museum of Royal College of Surgeons, Dublin, E., b. 913.
R. W. Smith: A Treatise on Fractures in the Vicinity of Joints, etc., Dublin, 1854, p. 197.
- (12) Museum of Royal College of Surgeons, Eng., No. 876.
Thamhayn: Inaug. Dissert. über die mit fractur des collum humer-c complicirten Schulter luxationen, No. 55.
- (13) St. Barthol. Hosp. Museum, London, G. 103.
Thamhayn: No. 36.
- (14) St. Thomas's Hosp. Museum, London, B. 9.
Thamhayn: No. 32.
- (15) Museum Royal College of Surgeons, Eng., No. 875, Oger, 7.
- (16) *Riberi*: Oger, 11.
- (17) *Smith, R. W.*: Dublin Quart. Journ. of Med. Sc., Vol. I, 1846, p. 220.
- (18) *Smith, R. W.*: Dublin Quart. Journ. of Med. Sc., Vol. XXV, 1844, p. 523.
- (19) *Travers*: Handbuch der Lehre. von den Knochenbrüchen, E. Gurlt. Obs. 97, p. 696.
- (20) Museum of Dupuytren, Oger, a. postscript.
- (21) Museum of Dupuytren, Oger, a. postscript.
- (22) Museum of Dupuytren, No. 729, Oger, a. postscript.
- (23) *Bottentuit*: Oger, No. 15.
- (24) *Bouilly*: Oger, No. 16.
- (25) *Deleurye et Dumont*: Oger, No. 18.
- (26) *Deleurye et Dumont*: Oger, No. 19.
- (27) *Dunn*: Brit. Med. Journ., Feb. 8. 1862, p. 140.
- (28) *Hamilton*: Trans. Am. Med. Assoc., Vol. IX, p. 93.
- (29) *Hart*: Brit. Med. Journ., 1862, I, p. 488.
- (30) *Houghton*: Oger, No. 23.
- (31) *Sotterer*: Schmidt's Jahrbücher, Bd. 107, p. 325.
- (32) *Ravatot*: Oger, No. 25.
- (33) *Redus*: Oger, No. 26.
- (34) *Richet*: Bulletin Général de Thérapeutique, Vol. XLV, 1893, p. 19.
- (35) *Richet*: Bulletin de la Soc. Chir., 1857-8.
- (36) *Ritter*: Oger, No. 29.
- (37) *Spence*: Edinburgh Med. Journ., Vol. VIII, Part II, 1863, p. 1084.
- (38) *Streubel*: Schmidt's Jahrb., Bd. CIV, p. 327.
- (39) *Terillon*: Oger, No. 32.
- (40) *Trélat*: Oger, No. 33.
- (41) *Volkmann, Thamhayn*: No. 20.
- (42) *Watson*: Am. Journ. Med. Sc., Vol. XXX, New Ser., p. 548, Obs. 1.
- (43) *Castex*: Poirier et Mauleaire, No. 98, Des Fractures de l'extrémité supérieure de l'humérus, Revue de Chirurgie, Oct., 1892.
- (44) *Von Mosengeil*: Archiv f. klin. Chirurgie, Vol. XVI, p. 524.
- (45) *Von Mosengeil*: Archiv f. klin. Chirurgie, Vol. XVI, p. 524.
- (46) *Berger*: La France Médicale, 1884, Vol. II, p. 1613, Obs. 1.
- (47) *Berger*: La France Médicale, 1884, Vol. II, p. 1615, Obs. II.
- (48) *Scalzi*: Poirier et Mauleaire, I.c., No. 88.

(49) *Scalzi*: Poirier et Mauclaire, l.c., No. 89.
 (50) *Hofmokl*: Wiener Med. Presse, 1881, p. 695.
 (51) *Marjolin*: Oger, No. 37.
 (52) *Weber*: Gurlt, Obs. 174.
 (53) *Watson*: Am. Journ. Med. Sc., Vol. XXX, New Series, p. 548, Obs. 11.
 (54) *Hartshorn*: Am. Journ. Med. Sc., Vol. XXIX, 1855, p. 272.
 (55) *Charron*: Poirier et Mauclaire, No. 90.
 (56) *Benjamin*: Med. and Surg. Reporter, Phila., 1888, p. 755.
 (57) *Cock*: Guy's Hosp. Rep., London, 1855, 3, S. 1., p. 282.
 (58) *De Marquay-Oulmont*: Oger, No. 39.
 (59) *De Marquay-Oulmont*: Oger, No. 40.
 (60) *Fischer*: Schmidt's Jahrbücher, civ, p. 326.
 (61) *Richel*: Oger, No. 42.
 (62) *Robert et Huguenin*: Bul. de la Soc. de Chir., 1867-8, 2 Juin, 1858, p. 521.
 (63) *Bergrath*: Oger, No. 44.
 (64) *Trelat*: Gazette d. Hôpital, 1889, p. 742.
 (65) *Schwartz*: Poirier and Mauclaire, No. 99.
 (66) Manchester Royal Infirmary, Provincial Med. and Surg. Journ., 1852, p. 267.
 (67) *Chany*: Oger, No. 45.
 (68) *Dupuytren*: Oger, 46.
 (69) *Heale*: Sir Astley Cooper, Fractures and Dislocations, 1835, New Ed., by Bransby B. Cooper, p. 420, case 248.
 (70) *Fergusson, Thamhayn*: No. 44.
 (71) *Fergusson, Thamhayn*: No. 45.
 (72) *Huigeston*: Guy's Hosp. Reports, v. p. 92.
 (73) *Delpach*: Chirurg. Clinique de Montpellier, 1823, t. 1, p. 233.
 (74) *Lallemand*: Ephemeride Cliniques des Montpellier, t. IV, p. 378.
 (75) *Lenoir*: Oger, No. 53.
 (76) *Malgaigne*: Oger, No. 55.
 (77) *Thoman, Thamhayn*: No. 62.
 (78) *Weber, Thamhayn*: No. 66.
 (79) *Williams*: Lancet, Sept., 1865, p. 289.
 (80) *Langenbeck*: Guilt., l.c., p. 689, case 101.
 (81) *Fraser*: Am. Journ. Med. Sc., 1869, p. 372.
 (82) *Manzini*: Atlas Lux. and Fract., Malgaigne, pl. xxi, Fig. 556.
 (83) *Wood*: N. Y. Journ. of Med., Vol. IV, 1850, p. 281.
 (84) *Champenois*: Oger, No. 63.
 (85) *Helmut*: Wochenschrift für der gesammte Heilkunde, 1884, p. 621.
 (86) *Morris*: Gurlt, Obs. 180.
 (87) *Decamps*: Poirier et Mauclaire, No. 92.
 (88) *Tripiere*: Poirier et Mauclaire, No. 97.
 (89) *Baroni*: Gazette des Hôpital., 1841, 17 avrيل.
 (90) *Langenbeck*: Gurlt., No. 172.
 (91) *Warren*: Boston Med. and Surg. Journ., No. 1, 1828, p. 12.
 (92) *Gosselin*: Oger, No. 67.
 (93) *Hamilton*: A Practical Treatise on Fractures and Dislocations, 3d Ed., Phila., 1866, p. 569.

(94) *Hamilton*: A Practical Treatise on Fractures and Dislocations, 3d Ed., Phila., 1866, p. 569.

(95) *Langenbeck*: Gurlt., No. 173.

(96) *Langenbeck*: Gurlt., No. 175.

(97) *Mohrenhein*: Gurlt., No. 102.

(98) *Trélat*: Oger, No. 73.

(99) *Berger*: La France Médicale, 1884, VOL. II, p. 1615, Obs. III.

(100) *Skey*: Med. Times and Gazette, 1860.

(101) *Nancrede*: Med. and Surg. Journ., 1884, p. 388.

(102) *Hamilton*: Am. Med. Times, VOL. I, p. 61.

(103) *Peyroni*: Oger, No. 74.

(104) *Peyroni*: Oger, No. 75.

(105) *Riberi*: Oger, No. 76.

(106) *Riberi*: Oger, No. 77.

(107) *Riberi*: Oger, No. 78.

(108) *Volkman, Thamhayn*: No. 64.

(109) *Mabboux*: Poirier et Mauclaire, l.c., p. 849, Obs. IV.

(110) *Sheen*: Lancet, 1876, p. 211.

(111) *Berlin*: Poirier et Mauclaire, p. 851, Obs. IX.

(112) *Morton*: Am. Journ. Med. Sc., 1884, VOL. LXXXVII, p. 173.

(113) *Croft*: Lancet, March 29, 1890, p. 701.

(114) *Tripiere*: Congrès. de Chir. 1886, p. 326.

(115) *Wölfler*: Wiener Medizinische Wochenschrift, 1891, No. 1, p. 6.

(116) Poirier et Mauclaire, l.c., p. 849, Obs. V.

(117) Poirier et Mauclaire, l.c., p. 850, Obs. VI.